A Benchmarking Study of State Telecommunications Networks

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Introduction

Too often states are unaware of other states' efforts and whether they succeed or fail. More shared information across states and across localities can yield a better understanding of the most viable approaches, and a pool of experts who can work with each other in crafting the most effective programs.

The purpose of this report is to provide a comparison of the Colorado Multi-use Network (MNT) to other state networks in order to assess the level of technology and readiness of Colorado's statewide telecommunications network. The MNT, nearing completion, has brought fiber connectivity to every county seat in the state. This connectivity is available to both private and public sectors, including state and local agencies, schools libraries, and hospitals.

State Network Overview

Every state has invested in some sort of telecommunications infrastructure to serve government agencies or the educational community. The infrastructure technology of these networks range from simple voice capability to high-speed, digitally switched networks for higher education and scientific research. Often, a state will have multiple networks to serve state agency needs, K-12 educational needs, and higher education needs. As a result of the variety of networks and numerous agencies associated with each, collecting accurate and reliable data has proven difficult. Table 1 below summarized data gathered from a variety of resources.

Table 1: A Overview of State Networks[1]

State	Network Type	Rural?	Name	Funding Plan
Alabama	State, Educational	Yes	AREN (Alabama Research and Educational Networks	Public
Alaska	State	No	State of Alaska WAN (ITG network)	User Fees
Arizona	Educational	Yes	TOPAZ (Telecommunications Open Partnerships for Arizona)	
Arkansas	Educational	No	ARKNet, APSCN	User Fees
California	Educational	No	CalRen, 4CNet, CENIC	Public
Colorado	State, Educational, Other	Yes	MNT (Multi Use Network)	Public / Private
Connecticut	Educational	Yes	Connecticut Educational Network	
Delaware	State, Educational	No	SITN	Public
Florida	Educational	No	FIRN, FloridaNet	Public
Georgia	State, Educational	Yes	PeachNet	
Hawaii	State, Educational	Yes	HERN	Public (NSF)
Idaho	State, Educational, Other	Yes	IDANET	Public
Illinois	State, Educational, Other	Yes	ICN (Illinois Century Network)	Public
Indiana	Educational	No	INDNet	User Fees
Iowa	State, Educational	Yes	ICN (Iowa Communications Network)	Public
Kansas	State, Educational, Other	No	KANREN	Public (NSF)
Kentucky	State	No	KTLN	no
Louisiana	State, Educational	No	LaNet	Public
Maine	Educational	No	MSLN	User Fees
Maryland	State, Educational	Yes	Net.work.Maryland	Public
Massachusetts	State, Educational	No	MITI	Public / Private
Michigan	State, Educational, Other	Yes	Merit	User Fees
Minnesota	State, Educational, Other	No	Onvoy	Private
Mississippi	State	No	MISNet	Public
Missouri	State, Educational	No	MOREnet	Public
Montana	State, Educational	Yes	Summit Net, MUSENet	Public
Nebraska	State, Educational	Yes	NEON (Nebraska Online)	
Nevada	Educational	No	Nevada Net	Public
New Hampshire	Educational	No	USNH Wide Area Network	

[1] Data primarily gathered from: "What are others states doing?" http://unebapps.uneb.edu/CSN/Networking/NetTechDoc.nsf/3cf90a23430db5a9852562840073ae37/42a061677e333d3286256b02007c337b?OpenDocument .

New Jersey	Educational	No	NJEDge.Net	User Fees
New Mexico	Educational	No	CHECSnet	User Fees
New York	Educational	No	NYSERNet	User Fees
North Carolina	State, Educational	Yes	NC – REN	Private
North Dakota	Educational	No	ND School Net, HECN	User Fees
Ohio	State	No	OarNet	User Fees
Oklahoma	State, Education	No	OneNet	User Fees
Oregon	Educational	No	NERO (Network for Education and Research in Oregon), OPEN (Oregon Public Education Network)	User Fees
Pennsylvania		No		
Rhode Island	State, Educational, Non-Profit	No	RINET (Rhode Island Network for Education Technology	Leased
South Carolina	State, Educational	No	SCIN (South Carolina Information Network)	Leased
South Dakota	State, Educational, Other	Yes	DDN (Digital Dakota Network)	Public
Tennessee	State	No	TNII	Public
Texas	Educational	No	TENET (Texas Educational Network)	Higher Ed
Utah	State, Educational	No	UtahLink	User Fees
Vermont	State, Educational	No	GOVnet, K12net	Public
Virginia	State, Educational, Other	No	Net.Work.Virginia	Public
Washington	Educational	No	K20TOPC	Public
West Virginia	State, Educational, Other	No	WVSUN (West Virginia State Unified Network)	Public
Wisconsin	Educational	No	WiscNet	Leased
Wyoming	State	Yes	Wyoming Internetwork	Public

Brief descriptions of state networks that may resemble the MNT follow. Of particular interest is the North Carolina Information Highway, which developed a state of the art backbone but neglected to fund the "last-mile" sufficiently. Both North Carolina and Maryland have plans to develop a state network providing rural access to broadband (Net.work.Maryland and the North Carolina Rural Access Authority)

Arizona NAUNet & TOPAZ (Telecommunications Open Partnerships of Arizona)
NAUNet is the state's distance learning network, which currently teaches ninety undergraduate and graduate courses each semester. Initiated in October of 2000, Arizona will spend $100 million over five years to bring broadband communications capabilities to over 160 rural communities.

Illinois Century Network
The Illinois Century Network is a telecommunications backbone to provide high-speed access to data, video, and audio communications in schools and libraries, at colleges and universities, to public libraries and museums, and for government services. Completed in 1999, to date, nearly 4,200 facilities and institutions are connected to the ICN. [2]

Ohio SONET
With initial funding from FY 1994-95, Ohio integrated a leaded fiber backbone with an 800 MHz radio system, replacing the existing microwave system. Ohio experienced the following benefits:

- Estimated annual savings in excess of $12 million
- $20 Million in costs avoided by not replacing state's aging microwave system
- $50 million less in capital expenditure and $1 million in operating expenditure by not building a stand alone radio communications system for public safety and emergency management.
- Universities and agencies paying ~$1000/month less for each line
- The cost of a T1 line on state contract dropped to one quarter the cost of a commercially purchased line resulting in the ability to acquire more robust communications capability at the end-user level.

Iowa Communications Network
ICN is a state managed and operated fiber optic network for connecting government, education, and medical facilities in all 99 Iowa counties. The network currently has over 750 full motion videos sites connected.

North Carolina Information Highway[3]
The North Carolina Information Highway (NCIH) provides state government entities with a broadband network for high-speed data, voice, and video. *One of the first statewide fiber optic networks, early users complained that little money was earmarked for institutions to connect to the backbone.*

TEX-AN[4]
TEX-AN is the statewide-consolidated telecommunications network for telephone, video, and data serving government and education. The state establishes the specifications for the network and allows the private vendor community to come up with infrastructure solutions to meet the demands of state agencies. For telecommunications services, the state has contracted for "postalized" rates with the state LEC. This means that the state will pay a set price for any circuit (56 Kbps, T1, etc.) ordered from the LEC within a LATA (Local Access and Transport Area). These contracted rates offer significant savings.

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[2] http://www.nascio.org/scoring/files/2001Illinois2.doc
[3] "Telecommunications Infrastructure Development: The State and Local Role", P99-12, The Rural Policy Research Institute, November 1999. www.rupri.org.
[4] ibid.

NET.WORK.VIRGINIA[5]
NET.WORK.VIRGINIA is an advanced, broadband network delivering ATM (asynchronous transfer mode) service statewide. In addition to serving government and education, private industry and other entities can connect directly to NET.WORK.VIRGINIA for the purpose of participating with educational programs.

Educational networks

Our research indicates that many statewide networks began as educational networks, which expanded to fulfill the state needs. One of the most comprehensive surveys found, performed by EDvance.net in 1999, directly targeted educational networks. The survey, sent to all 50 states plus the District of Columbia, received 48 responses, thirty-four of which reported having a K-12 Educational Network. A summary of key findings follows:

Governance

State education networks have diverse governance structures. Sometimes they are autonomous, stand alone entities, and other times they fall under the aegis of other agencies such as the state department of education, higher education, the state legislature, or the state public service commission, and even private non-profit corporations. Appendix A provides an overview of the statewide education networks, their names and URL, the chief operating officer, and the person with overall responsibility. It is clear that the majority of statewide networks are found in the state departments of education; however, it is also clear that there are nearly as many governance models as there are statewide education networks! [6]

Funding models

- 27 – State Funding
- 15 – Fee for Service
- 3 – Private Funds or Foundations
- 1 – University

Type of Network

- 15 – Stand Alone
- 19 – Within Large Network

Internet access from home (dial in)

- 15 – Teachers Only
- 10 – Teachers and Students
- 8 – No Access

[5] ibid.
[6] **http://www.edvancenet.org/res_statewide.pdf**.

During the 2000 "Gathering of State Networks, Strategies for the Next Decade," hosted by EDUCAUSE, surveys[7] were completed by approximately 30 of the states represented at the conference. Key findings in pie graph format can be found in Appendix B (separate power point file). Items of note at the time of the study, April of 2000:

- 73% of the respondents provide ongoing consulting to the users
- 70% provide video conferencing
- only 20% offered Voice over IP services.

New Economy Measurements

In 1999 and again in 2002, the Progressive Policy Institute published a State New Economy Index utilizing a number of measures grouped as Knowledge Jobs, Globalization, Economic Dynamism, Digital Economy, and Innovation Capacity. The report also includes a discussion on Economic Development Strategies.[8]

Colorado rated strong in both surveys, ranking 3rd overall in 1999, and 4th in 2002. However, behind the overall rankings there are some significant issues needing deserving further attention such as Technology in Schools, Digital Government, Broadband Deployment, and to a lesser extent, Online Population. Table 2 below shows some of the changes from 1999 to 2002.

[7] http://www.educause.edu/netatedu/states/surveydata.pdf.
[8] http://www.neweconomyindex.org/states/2002/strategies.html .

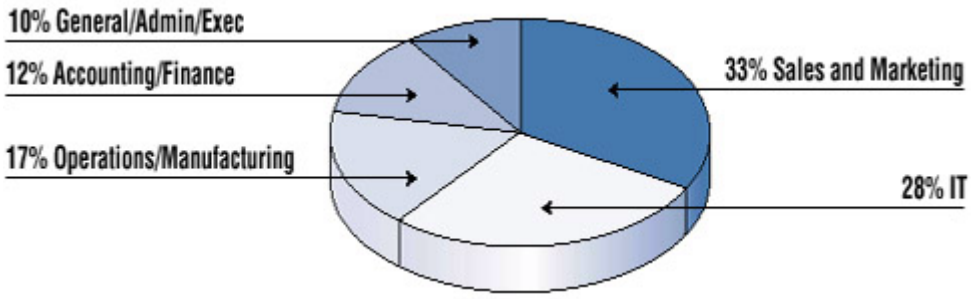
Table 2: A comparison of select New Economy Rankings[9]

Colorado	1999 Ranking	2002 Ranking
Overall Rank	3	4
Online Population: The percentage of adults with Internet access in each state.	2	11
Commercial Internet Domain Names: The number of commercial Internet domain names per firm.	6	13
Technology in Schools: A weighted measure of five factors measuring computer and internet use in schools.	13	21
Digital Government: A measure of the utilization of digital technologies in state governments.	30	35
Managerial, Professional, and Technical Jobs as a share of total workforce.	4	8
Workforce Education: A weighted measure of the educational attainment of the workforce.	1	2
High Tech Jobs: Jobs in electronics manufacturing, software, telecom, and biomedical as a share of total employment.	2	2
"Gazelle" Jobs: Jobs in high growth companies as a share of total employment.	28	13
Job Churning: The number of new start-ups and business failures, combined, as a share of all establishments in each state.	3	6
Initial Public Offerings: A weighted measure of the value and number of initial public stock offerings of companies as a share of gross state product.	4	4
Industry Investment in R&D: Industry investment in R&D as a percentage of Gross State Product (GSP).	15	12
Venture Capital: Venture capital invested as a percentage of GSP	3	3

Information in several categories (some not shown in the table above), which includes a description of the category, it's meaning, an analysis, and the top 10 states by category can be found in Appendix C. Colorado ranks 35th in Digital Government, 21st in Technology in Schools, and 15th in Broadband Telecommunications. Note that Information Technology jobs relates to employment IT occupations in non-IT industries as a share of total jobs.

[9] The 2002 New Economy Index, The Progressive Policy Institute http://www.neweconomyindex.org/states/2002/colorado.html. The 1999 New Economy Index, The Progressive Policy Institute http://www.neweconomyindex.org/states/1999/colorado.html.

Internet-related jobs are not just in Information Technology
Of the Internet-related jobs, only 28 percent are in Information Technology, which ranks below Sales and Marketing (33 percent) as the job function generating the most Internet-related employment. What this reflects is the impact the Internet is having on traditional businesses and jobs - from sales and manufacturing to finance and accounting positions.[10]



Analysis & Conclusion

The Colorado MNT, a state of the art telecommunications network, can be considered among the upper echelon of state networks. The public/private partnership and concepts of demand aggregation are cutting edge. However, there are still some serious shortfalls to be considered. Although the network backbone is near completion, it appears that utilization of that backbone is the major challenge to be faced. Colorado needs to take advantage of the MNT in order to boost its technology in schools and digital government. The impact of use of consultants to educate and facilitate connection of the last mile cannot be underestimated. Detailed studies showing the savings from demand aggregation efforts and from the drop in costs per MB may go a long way in justifying funding that facilitates last mile connectivity and stimulates demand among rural communities.

The Progressive Policy Institute's New Economy report discusses eight key steps for economic development:

1) Focus on the quality, not just the quantity of jobs
2) Know your state's function in the global economy
3) Get smart about business incentives
4) Co-invest in the skills of the workforce
5) Co-invest in an infrastructure for innovation
6) Support industry clusters
7) Boost quality of life
8) Help more regions succeed in the New Economy

While the MNT program addresses several of these steps, careful attention should be paid to the others to ensure Colorado's success in the future.

[10] www.internetindicators.com.

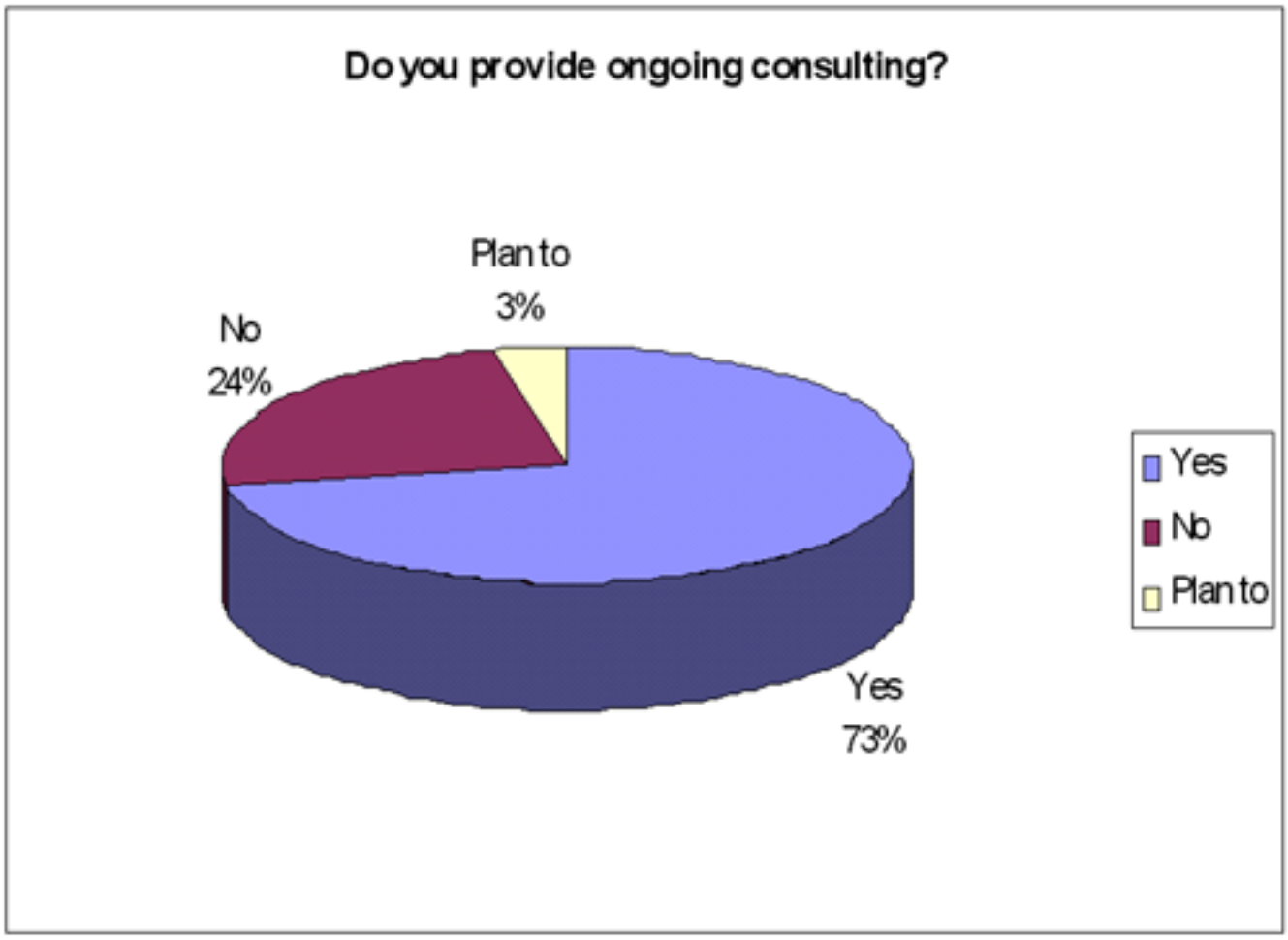
Appendix A:
Descriptive Information about
Statewide Networks

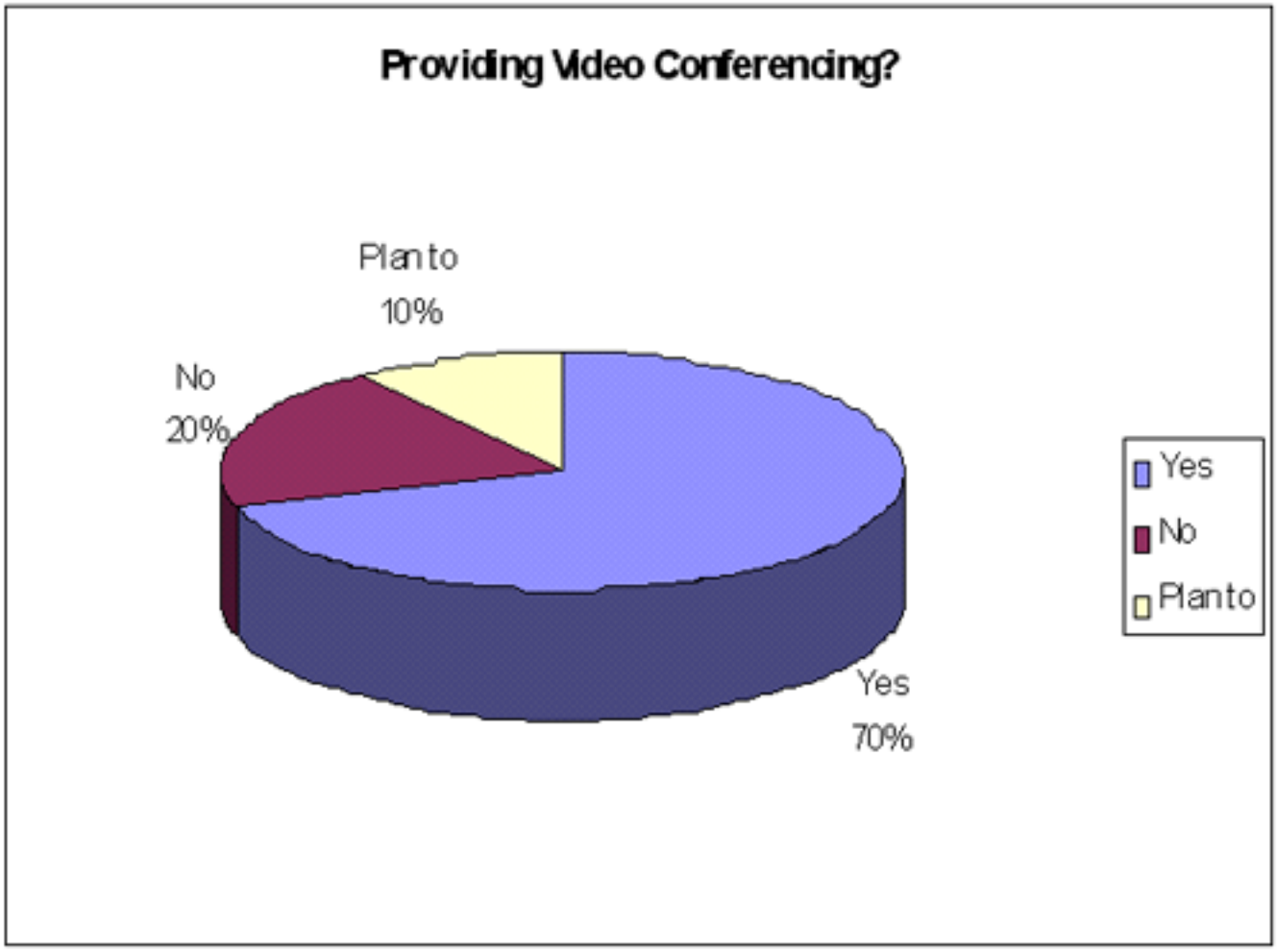
State	State Education Network	URL	COO	Reports To
AK	None			
AL	None			
AR	Arkansas Public School Computer Network	www.k12.ar.us	Steve Colbert, Associate Dir. Arkansas Dept. of Ed	Ray Simon, Director Arkansas Dept. of Ed
AZ	Arizona Dept. of Ed. Homepage	www.ade.state.az.us	John Schilling, Chief of Policy and Planning	Lisa Graham Keegan, Superintendent of Public Instruction
CA	None			
CO	None			
CT	None			
DC	DC Public Schools Wide-Area Network	www.k12.dc.us	Ulysses Keyes, Director of MIS	Arlene Ackerman, Superintendent
DE	Delaware Education Network (DEN)	www.k12.de.us	Peter LaVenia, Director, Office of Telecommunications/Colleen Gause, LAN/WAN systems	Jack Nold, Office of Information Service, Executive Director
FL	Florida Information Resource Network (FIRN)	www.firn.edu	Bill Schmid, Director, FIRN	George Haynie, Deputy Commissioner, Tech. & Admin.
GA	PeachNet	www.usg.edu/peachnet/	Dr. Thomas Maier, Executive Director, ETIS, Board of Regents, Univ. of GA	Randall Thurshy, Assoc. Vice Chancelor for Information and Inst. Tech., , Board of Regents, Univ. of GA
HI	HI K12 Network	www.k12.hi.us/nssb	K.Kim, Telecommunications Director	Diana Oshiro, Assistant Superintendent
IA	Iowa Communications Network	www.iptv.org/iowa_database	General Tommy Thompson, Chief Operating Officer	Iowa Telecommunication and Technology Committee (5 members)
ID	None			
IL	Linc-On	http://www.isbe.state.il.us	Frank Whitney, Division Administrator of Infastructure	Associate Superintendent
IN	IDEANET	ideanet.doe.state.in.us	Micheal Huffman, Special Administrator of Infastructure	Dr. Suellen Reed, Superintendent of Public Instruction
KS	None			
KY	No Survey Returned			
LA	LANET	www.doe.state.la.us	Jane Petterson, Manager, LANET	Bud Lanier, Director, Office of Telecommunications
MA	Mass Community Network		Gregory G. Nadeau, Chief Technology Officer	David P. Driscoll, Commissioner of Education
MD	None			
ME	Maine School and Library Network	www.msln.maine.edu/	Joanne Steneck, Chair MSLN Advisory Board	Public Utilities Commission
MI	MichNet	www.merit.edu	Eric Aupperle, President, Merit Network	Merit's Board
MN	No Survey Returned			
MO	Missouri Research and Education Network (MOREnet)	www.more.net	William Mitchell, Executive Director	Ralph Caruso, Vice-President Information Systems Info Tech, Univ. of MO
MS	MDE State Backbone Network	www.mde.k12.ms.us	Nathan Slater, Director of Management Information Systems	Superintendent of Education
MT	met.net	www.metnet.state.mt.us/main.html	Steve Meredith, Administrator	Scott Buswell, Div. Head of Info. Services
NC	North Carolina Integrated	www.state.nc.us/ITS	Jim Broadwell, State Telecommunication Director/ Benny Hendrix, NC DPI Networking Technologies Director	Rick Webb, CIO/Debra C. Jones, CIO/NCDPI
ND	SENDIT	www.sendit.nodak.edu	Jody French, Project Coordinator	Bonnie Neas, Director of Information Technology Services
NE	K-12 Educational Information System	None	Alan Wibbles, Director of Technology	Terry Miller, President of Information Network Educational Service Unit Administrators Assn.
NH	None			

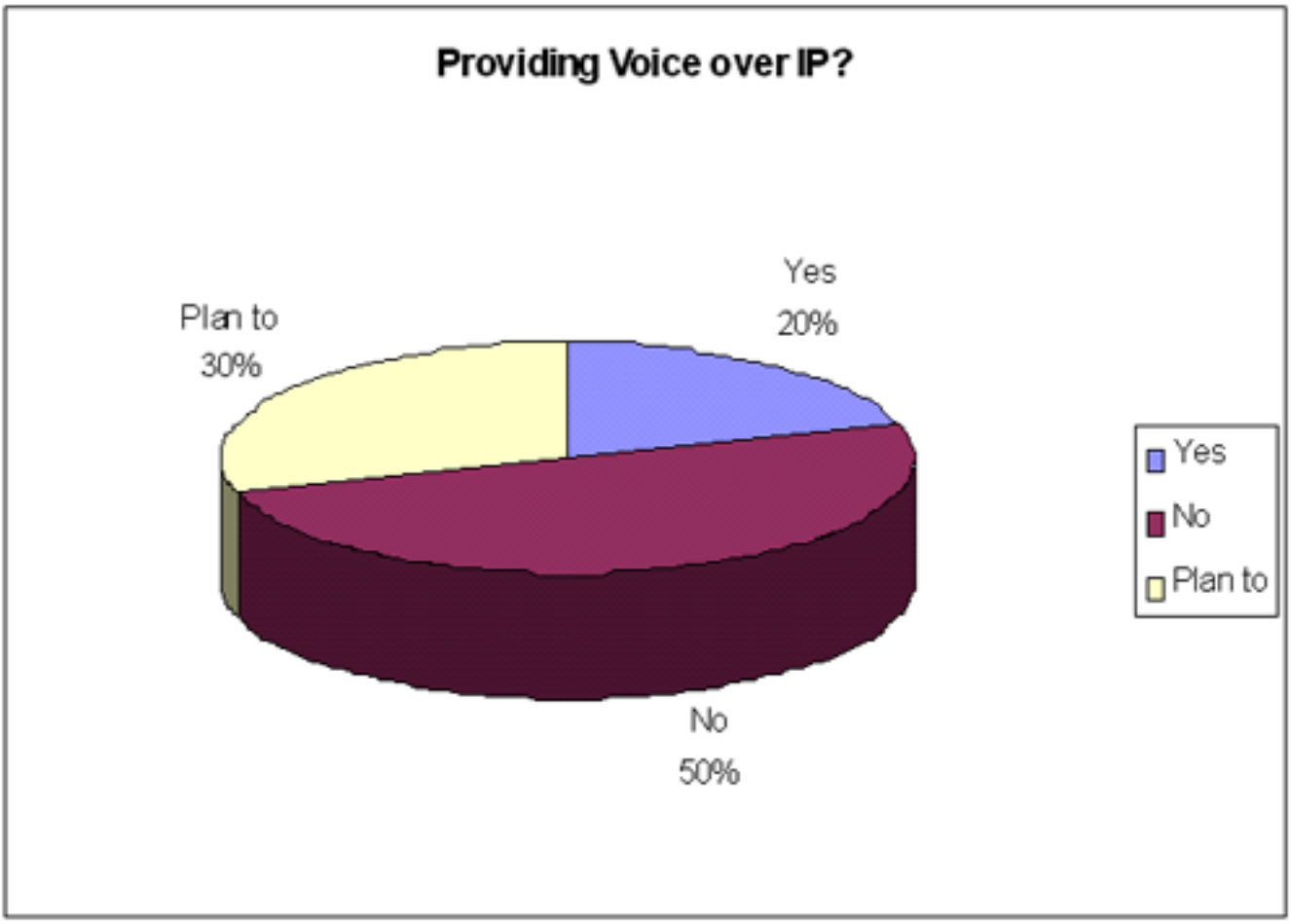
State	State Education Network	URL	COO	Reports To
NJ	None			
NM	None			
NV	Nevada School Network	www.nsn.k12.nv.us	Frank South, Director of HR and Technology	Mary Peterson, Supr. Of Public Instruction
NY	None			
OH	Ohio Educational Computing Network	www.oecn.ohio.gov	Bruce Hawkins, CEO	Robert Luikart, Info. Tech. Officer, Ohio Department of Education
OK	OneNet	www.onenet.net	Bill Schaffer, Assistant Director, Office of State Finance/Gary Smith, Oklahoma State Regents for Higher Education Chief Operating Officer & Executive Vice-Chancellor	Oklahoma State Legislature
OR	Oregon Public Education Network (OPEN)	OPEN.k12.or.us	Tom Cook, Director OPEN	OPEN Steering Committee
PA	PA Education Network	www.L2L.org	John Bailey, Director of Ed. Tech., PA Dept. of Ed.	Secretary of Education
RI	The Rhode Island Network for Educational Technology	ww.ri.net/RINET/index.html	Norman Chapman, Executive Director	RINET Board of Directors, chaired by William Fiske
SC	SCINET	www.state.sc.us	Ted Lightle, Director, Office of Information Resources	Fred Carter, Executive Director, SC State Budget & Control Board
SD	None			
TN	ConnectTEN	www.connect-tn.org	Jacqueline Shrago, Director ConnecTEN	Vernon Coffey, Commissioner Network Contract to Education Networks of America
TX	Texas Education Telecommunications Network (TETN)	www.tea.state.tx.us	Paul Faaborg, Video Manager; Richard Schults Data Manager	TETN Governance Board
UT	Utah Education Network	www.uen.org	Steve Hess, Executive Director	Ted Capener, VP University Relations, Univ.of Utah
VA	Virginia's PEN (VA.PEN)	www.pen.k12.va.us	Jerry Mathews, Director	Bethann Canada, Director of MIS
VT	Vermont K12NET	www.state.vt.us/govnet/k12net.htp	Patricia A. Urban, C.I.O./ Deputy Secy of Admin	Secretary of Administration
WA	K-20 Network	www.wa.gov/dis/k20	Telecommunications Policy Oversight Committee	Telecommunications Policy Oversight Committee
WI	None			
WV	WVEIS	access.k12.wv.us	Henry Blosser, Director WVNET/WVSUN; Matt Brown, IS & C Telecommunications	
WY	No Survey Returned			

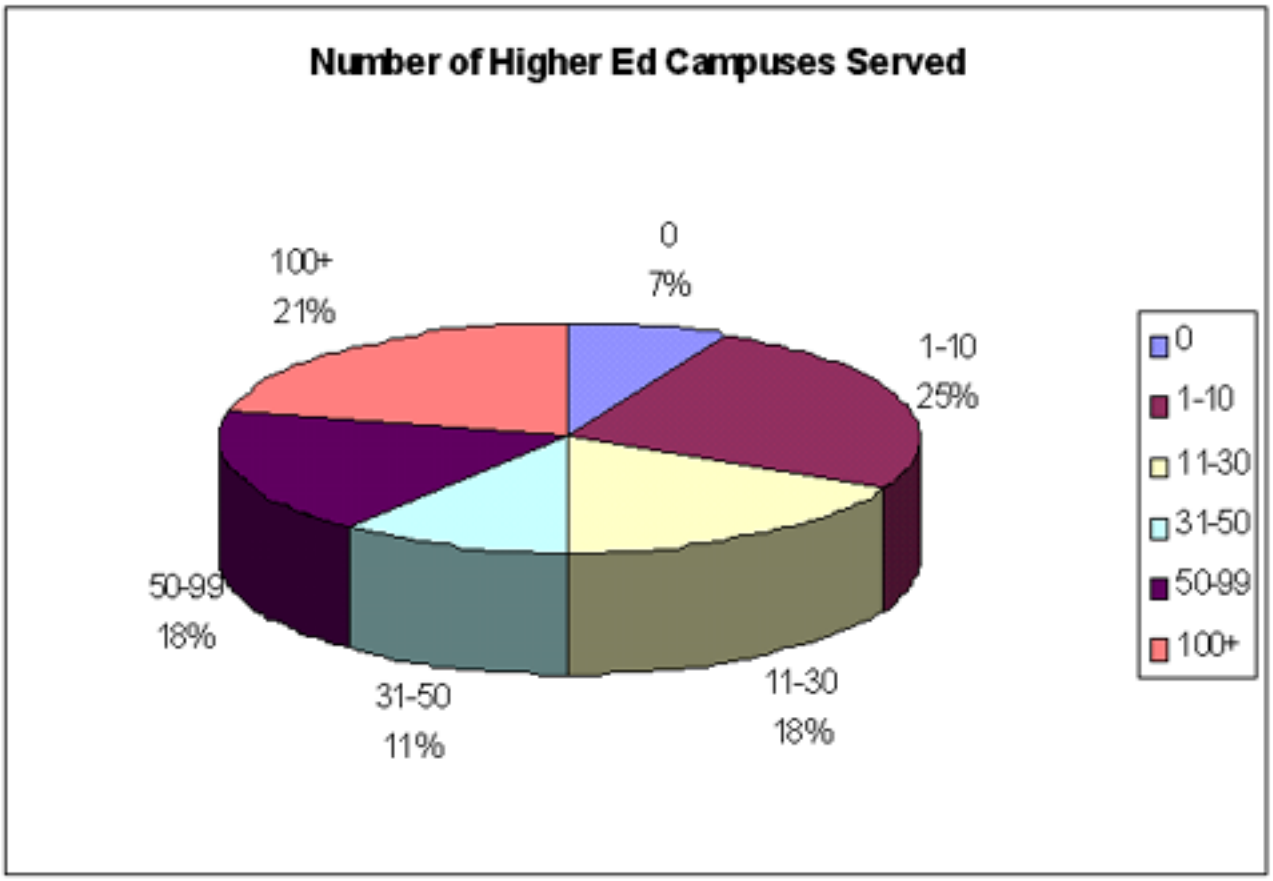
Appendix B

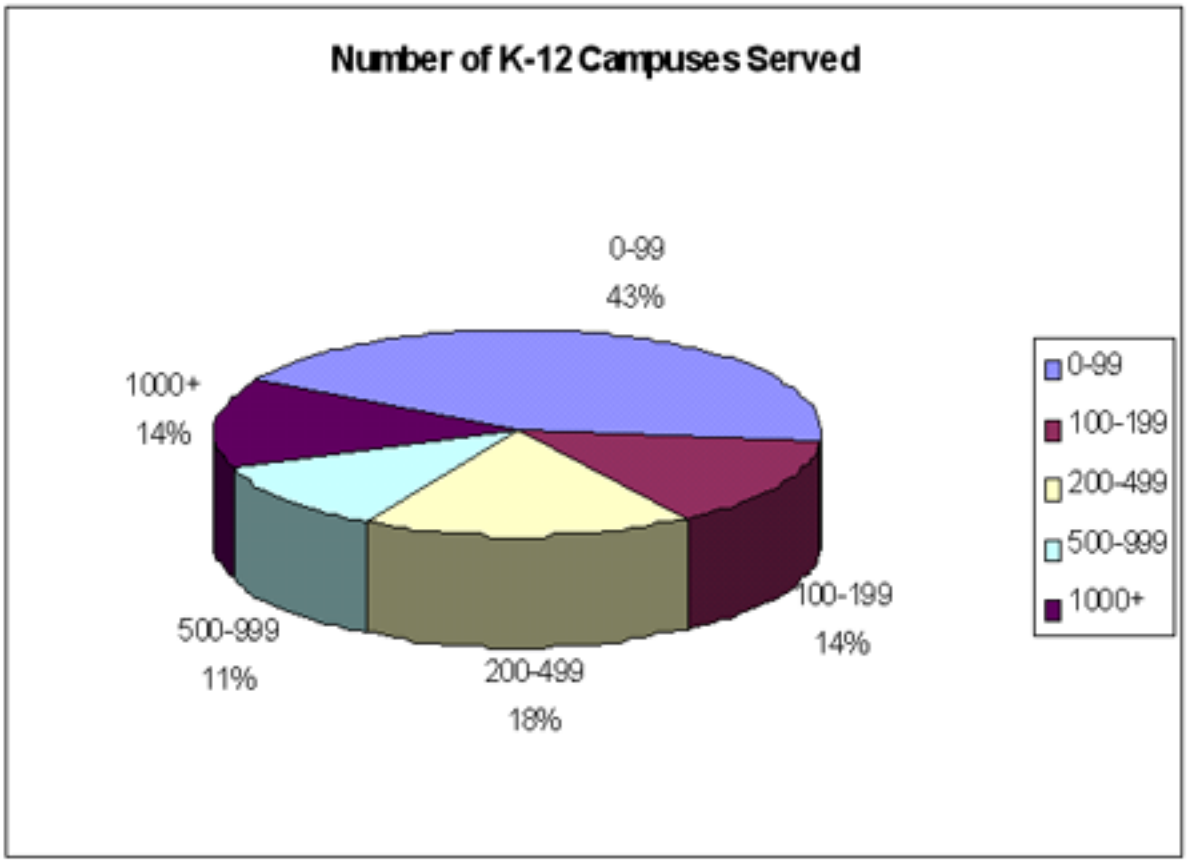
Key Survey Findings from
A Gathering of State Networks, 2000

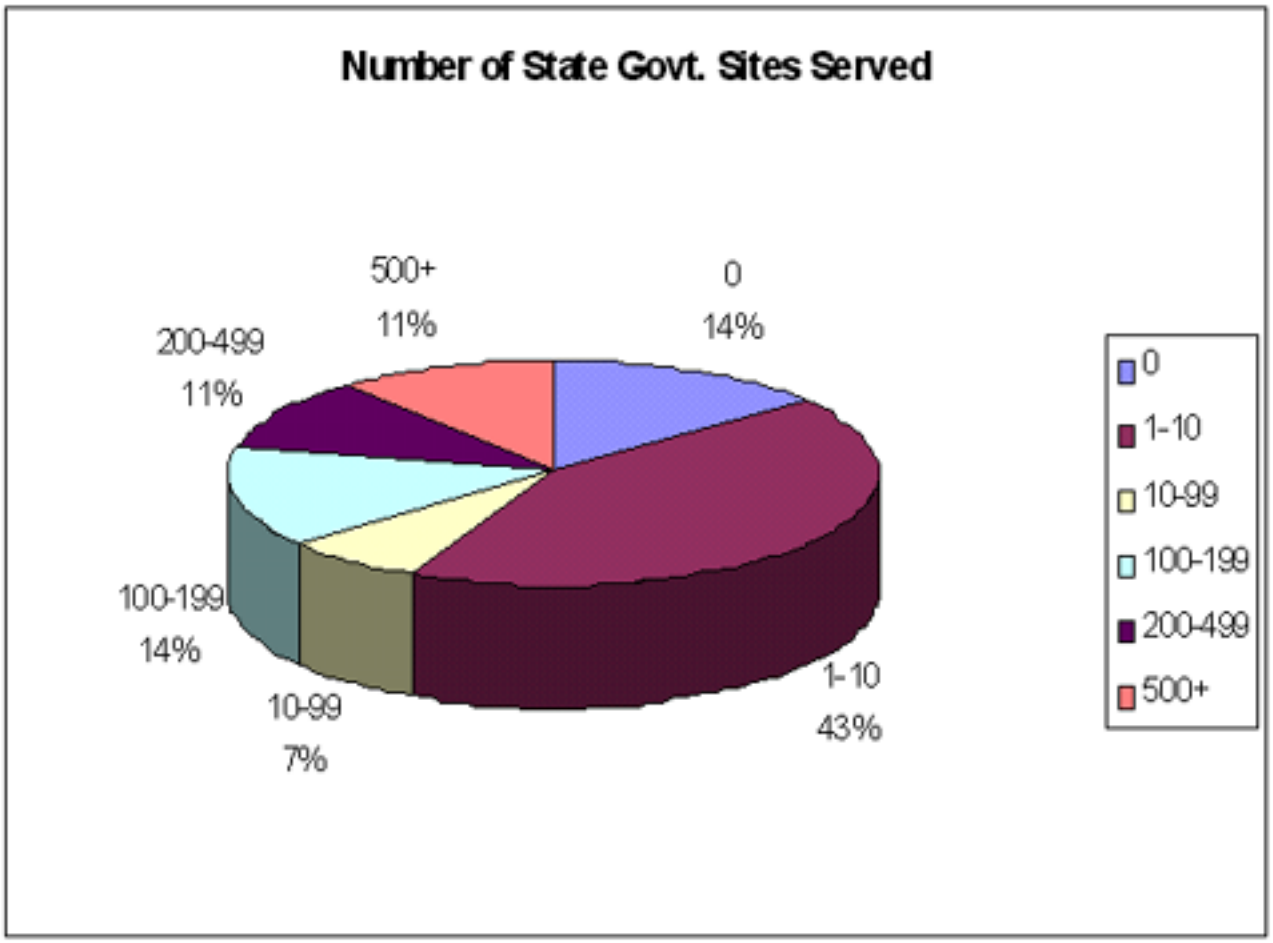


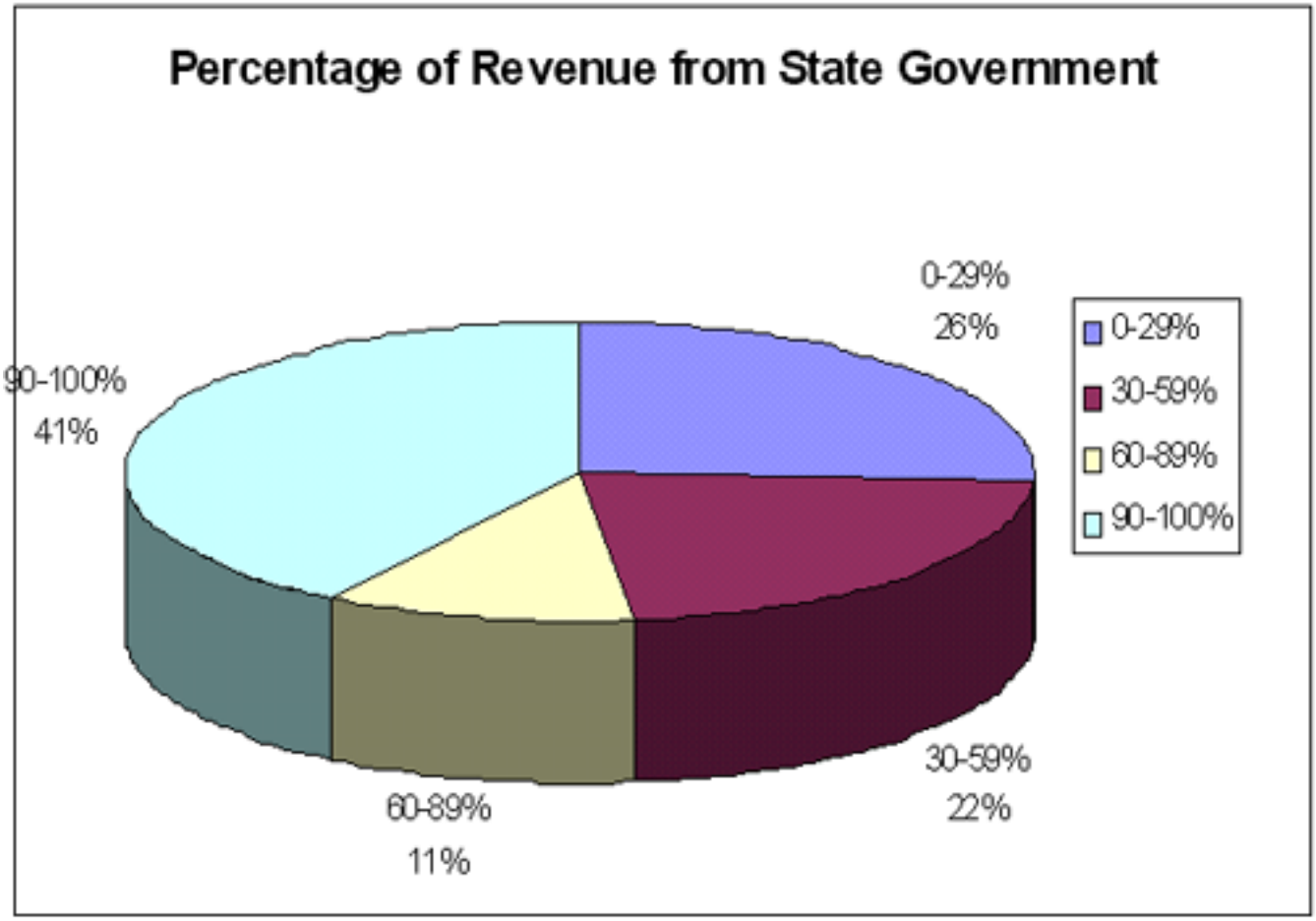

Providing Video Conferencing?
Plan to
10%
No
20%
Yes
70%
Yes
No
Plan to

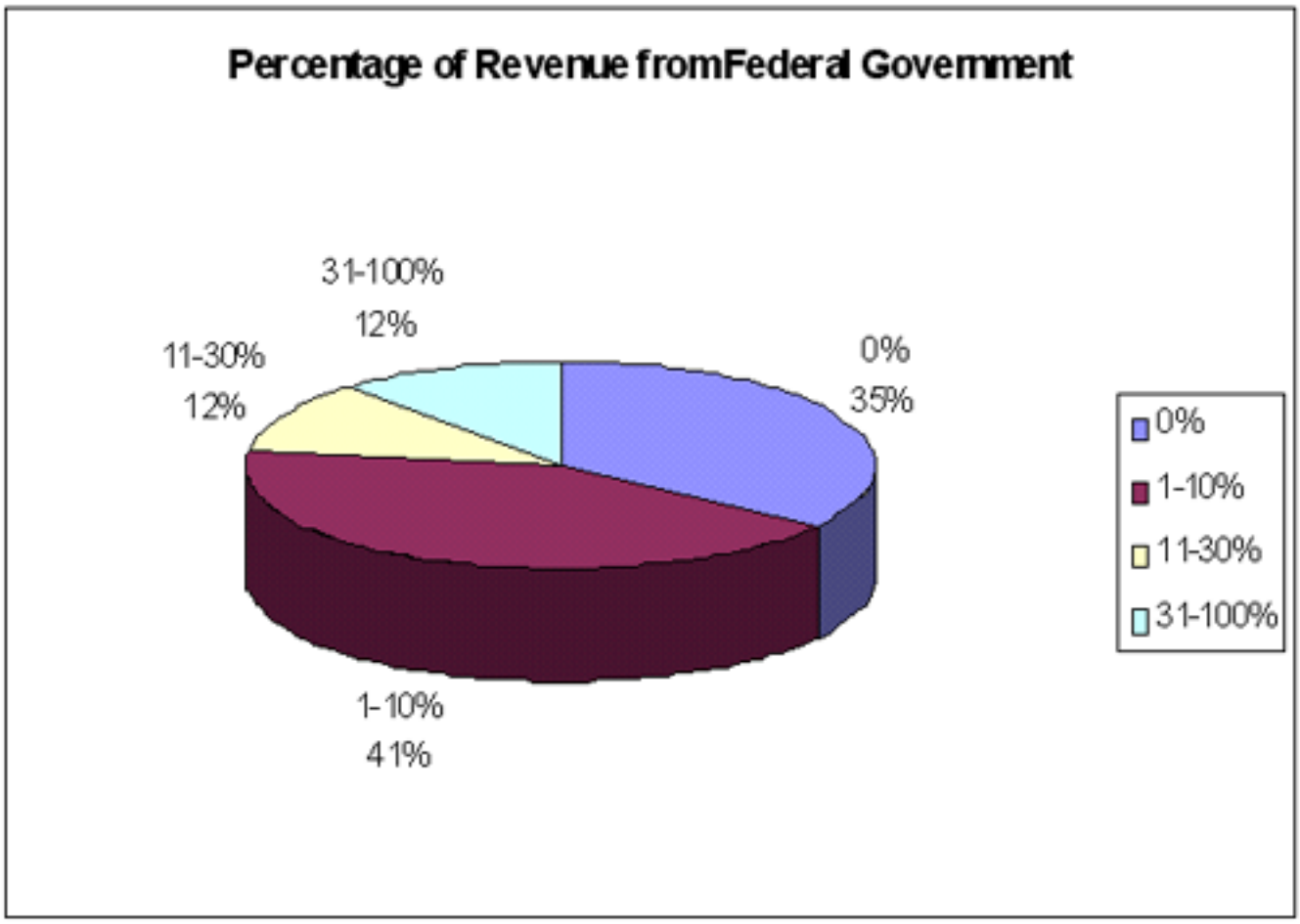

Providing Voice over IP?
Yes
20%
Plan to
30%
No
50%
Yes
No
Plan to


Number of Higher Ed Campuses Served
0
7%
1-10
25%
11-30
18%
31-50
11%
50-99
18%
100+
21%
0
1-10
11-30
31-50
50-99
100+


Number of K-12 Campuses Served
0-99
43%
100-199
14%
200-499
18%
500-999
11%
1000+
14%
0-99
100-199
200-499
500-999
1000+


Number of State Govt. Sites Served
500+
11%
0
14%
200-499
11%
100-199
14%
10-99
7%
1-10
43%
0
1-10
10-99
100-199
200-499
500+


Percentage of Revenue from State Government
0-29%
26%
30-59%
22%
60-89%
11%
90-100%
41%
0-29%
30-59%
60-89%
90-100%


Percentage of Revenue fromFederal Government
31-100%
12%
11-30%
12%
0%
35%
1-10%
41%
0%
1-10%
11-30%
31-100%

Appendix C:

Select categories taken from
The Progressive Policy's
2002 State New Economy Rankings
All rankings include the top 10 states plus Colorado.

Broadband Telecommunications

A measure of the use and deployment of broadband telecommunications infrastructure over telephone lines.

"While over 70 percent of households have broadband telecommunications available to them, only 12 percent actually buy it. But that number is growing as more broadband applications become available."

WHY IS THIS IMPORTANT? The ability to transfer large amounts of data is largely determined by bandwidth, the carrying capacity of the connections, or the "size of the pipes" between the sender and receiver of the data. Greater bandwidth allows faster transmission of larger amounts of data, something that is critical for the increasing number of businesses that use the Internet to communicate with customers, suppliers, and other parts of the company. But broadband access for households is also important, not only enabling a state's residents to more robustly engage in e-commerce, but also enabling telecommuting, distance education, tele-medicine, and a host of other applications that can boost productivity and quality of life. However, while over 70 percent of households have broadband telecommunications available to them (about two thirds of rural users have broadband access), only 12 percent actually buy it. But that number is growing as more broadband applications become available.

THE RANKINGS: The two states with the most broadband are two of the most high-tech states, Massachusetts and California. In addition, because broadband is still relatively expensive, high scoring states tend to be higher income states. Because it's cheaper to deploy broadband in metropolitan areas, states that are more densely populated tend to have higher levels of broadband. As a result, the lagging states (e.g., Alaska, Mississippi, West Virginia, and Vermont) have more rural and/or lower income populations.

Rank	State	Score
1	Massachusetts	5.42
2	California	5.22
3	New Jersey	4.74
4	Nevada	4.45
5	New York	4.44
6	Connecticut	4.43
7	Rhode Island	4.22
8	Washington	4.03
9	Arizona	3.96
10	Florida	3.77
15	Colorado	3.47

Information Technology Jobs

Employment IT occupations in non-IT industries as a share of total jobs.

"The average worker has more than $8,000 of IT hardware at her disposal."

WHY IS THIS IMPORTANT? The Information Technology revolution continues to permeate the economy. As it does, states with a larger share of workers trained and skilled in the use of information technology will do better than states with a smaller share. And it's not just software and computer companies that employ workers skilled in information technology; it's virtually all sectors. For example, more than 90 percent of IT professionals in the Chicago area are employed by firms that use IT (such as insurance, banking, and health-care administration) rather than those that produce IT or provide IT services. Even "traditional" industries use IT, such as the automobile industry, which employs thousands of IT professionals designing and managing Web sites, operating electronic ordering systems, and using software to design and build cars. As a result, the average worker has more than $8,000 of IT hardware at her disposal.

THE RANKINGS: Even after controlling for the size of states' software and IT-producing industries, in order to measure IT jobs in non-IT sectors, most of the states with high scores are high-tech states such as Colorado, Washington, and Massachusetts. Low-scoring states tend to have natural resources or traditional manufacturing-based economies.

Rank	State	Score
1	Colorado	3.3%
2	Washington	2.8%
3	Virginia	2.5%
4	Massachusetts	2.5%
5	Maryland	2.4%
6	New Mexico	2.2%
7	Utah	2.2%
8	Connecticut	2.2%
9	California	2.2%
10	Delaware	2.1%

Online Population

The percentage of the population with Internet access in each state.

"As more and more places get Internet access, the percentage of Internet users in rural areas is now almost even with the national average."

WHY IS THIS IMPORTANT? The number of people online is probably the most basic indicator of a state's progress toward the digital economy. At the end of 1998, one-third of American households were online; by November 2001, 50 percent were and even a greater percentage of adults were online. (Some people have access at work or school and not at home.) The average income and education levels of Internet users continue to drop so that the online population is looking like the American population in general. Moreover, as more and more places get Internet access, the percentage of Internet users in rural areas is now almost even with the national average.

THE RANKINGS: States differ significantly in the degree to which their residents are online. At the end of 2001, approximately 69 percent of Alaska's population had Internet access compared to 43 percent in Louisiana and 42 percent in Mississippi. In general, residents of Southern and Plains states are less likely to be online than residents of Pacific, Mountain, and Northeast states.

Rank	State	Score
1	Alaska	68.8%
2	Minnesota	63.5%
2	New Hampshire	63.5%
4	Wyoming	62.3%
5	Maryland	61.4%
5	Utah	61.4%
7	Washington	61.3%
8	Oregon	61.2%
9	Vermont	60.5%
10	Maine	60.4%
11	Colorado	60.1%

Technology in Schools

A weighted measure of five factors measuring computer and Internet use in schools.

"The percentage of classrooms with Internet access has gone from 27 percent in 1997, to 82 percent in 2000."

WHY IS THIS IMPORTANT? There is increasing evidence that when used right, computers and the Internet boost educational out-comes. Not surprisingly, the use of information technology in America's schools is growing. The percentage of schools with at least one Internet connection has increased rapidly, from 78 percent in 1997, to 94 percent in 2000, while the percentage of classrooms with Internet access has gone from 27 percent in 1997, to 82 percent in 2000.

THE RANKINGS: A number of states that are furthest ahead in integrating information technology into schools are the less populated and more geographically dispersed states, suggesting that a motivating factor is the desire to establish better connections to information and resources in other parts of the nation and the world. Political leaders in these and other states may recognize that the IT revolution is an important key to their future prosperity and that it is essential to properly train the next generation of workers. Surprisingly, a number of states with strong technology economies score notably low on this measure, including Connecticut, Maryland, New Hampshire, and California, which ranks last.

Rank	State	Score
1	Nebraska	3.82
2	South Dakota	3.64
3	Delaware	3.58
4	Ohio	3.47
5	Iowa	3.37
6	Alaska	3.35
7	Minnesota	3.21
8	Wyoming	3.05
9	Missouri	2.94
10	South Carolina	2.94
21	Colorado	2.31

Digital Government

A measure of the utilization of digital technologies in state governments.

"The next phase of e-government — breaking down bureaucratic barriers to create functionally-oriented, citizen-centered government Web presences — has only just begun."

WHY IS THIS IMPORTANT? State governments that fully embrace the potential of networked information technologies will not only increase the quality and cut the costs of government services, but also help to foster broader use of information technologies among residents and businesses. In the last few years, state governments have made considerable progress, first putting up Web sites, then using the Internet to allow individuals to interact with government — from paying taxes to renewing drivers' licenses. But the next phase of e-government — breaking down bureaucratic barriers to create functionally oriented, citizen-centered government Web presences designed to give citizens a self-service government — has only just begun.

THE RANKINGS: States with a tradition of "good government," such as Michigan, Utah, and Washington, appear to have gone farther along the path toward digital government than states without this tradition. But this relationship is not completely predictive. In part, this may be because digital government efforts appear to be driven by the efforts of particular individuals — governors, secretaries of state, legislative committee chairmen — who believe that their states should move in this direction. In addition, because making the transformation to a digital government is expensive, more populous states with bigger budgets also tend to score higher.

Rank	State	Score
1	Michigan	4.49
2	Washington	4.38
3	Texas	4.34
4	Indiana	4.29
5	Ohio	3.85
6	Pennsylvania	3.85
7	Florida	3.83
8	New York	3.72
9	Maine	3.70
10	California	3.68
35	Colorado	2.79

Online Agriculture

A measure of the percentage of farmers with Internet access and who use computers for business.

"The degree to which farmers embrace New Economy practices will increasingly determine their competitive success."

WHY IS THIS IMPORTANT? While agriculture accounts for less than 5 percent of employment, in many states agriculture remains an important sector. Like most economic sectors, the New Economy is transforming agriculture. Farmers and ranchers increasingly use the Internet to buy feed and seed, to check on weather conditions, to gain the latest technical information, and even to sell their livestock or crops. Farmers are also embracing mass customization, diversifying into new and varied crops and food products. The degree to which farmers embrace New Economy practices will increasingly determine their competitive success. One measure is the percentage of farmers with Internet access who use computers to run their farms.

THE RANKINGS: Farmers in Western states lead the nation in use of computers and access to the Internet. The top 12 states are all Western and Mountain states, with New England states also scoring high. Southern states generally score low.

Rank	State	Score
1	Idaho	5.0
2	Oregon	4.6
3	Montana	4.5
4	Arizona	3.9
4	Colorado	3.9
4	Utah	3.9
4	Nevada	3.9
4	Wyoming	3.9
4	New Mexico	3.9
10	Washington	3.9

Online Manufacturers

The percentage of manufacturing establishments with Internet access.

"Workers employed in manufacturing plants with more technologies earn 63 percent more than workers in plants using less."

WHY IS THIS IMPORTANT? In the New Economy, success for manufacturers and their employees will come as a result of the degree to which they embrace technology, both in how they make products and incorporate technology into their products. Workers employed in manufacturing plants with more technologies (e.g., computer-aided design, CNC machines) earn 63 percent more than workers in plants using less. One key technology that manufacturers are embracing is the Internet. In 2000, over 84 percent of manufacturers were online. By the end of 2002, more than 54 percent plan to be able to accept orders from customers online, with 40 percent planning to offer online customer support.

THE RANKINGS: The percentage of manufacturers online ranges from 92 percent in Minnesota to 67 percent in Delaware. While there is no clear geographic pattern to the rankings, there are a few surprises. For example, California ranks 32nd, while New York, generally viewed as a high-tech state, ranks 47th. These differences could result from the size mix of a state's industrial base, as smaller manufacturers are less likely to be online.

	Minnesota	91.7%
2	North Dakota	90.3%
3	Maine	89.5%
4	Indiana	89.0%
5	Louisiana	88.9%
6	Oregon	88.7%
7	Wyoming	88.6%
8	South Carolina	88.4%
9	Oklahoma	88.0%
10	Connecticut	87.9%
21	Colorado	86.6%